



PATENT
Customer No. 22,852
Attorney Docket No. 9981.0007-01

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:)
)
Miodrag CEKIC , et al.) Group Art Unit: 2881
)
Application No.: 10/632,893) Examiner: Phillip A. Johnston
)
Filed: August 4, 2003) Confirmation No.: 2897
)
For: APPARATUS FOR AND METHOD)
OF TREATING A FLUID)

Mail Stop Appeal Brief--Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPEAL BRIEF UNDER 37 C.F.R. §§ 41.31 and 41.37

This is an appeal to the Board of Patent Appeals and Interferences from the final Office Action mailed December 13, 2005, finally rejecting claims 1-79 in association with the above-referenced patent application. On May 11, 2006, a fee payment of \$500.00 in accordance with 37 C.F.R. § 41.20(b)(1) was timely filed with a Notice of Appeal under 37 C.F.R. § 41.31 and a Pre-Appeal Brief Request for Review. A "Notice of Panel Decision from Pre-Appeal Brief Review" was mailed June 20, 2006. Pursuant to 37 C.F.R. § 41.37, Appellant submits one copy of this Appeal Brief accompanied by a Petition requesting a three-month extension of time and fee payment filed concurrently herewith. Accordingly, this Appeal Brief is timely filed. If any additional fees are required or if the enclosed payment is insufficient, Appellants request that the required fees be charged to Deposit Account No. 06-0916.

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I. Real Party In Interest

Fusion UV Systems, Inc. is the assignee of record of this application as evidenced by the Assignment recorded in the U.S. Patent & Trademark Office on August 4, 2003, at reel 014359, frame 0825.

II. Related Appeals And Interferences

Appellants' undersigned legal representative knows of no other appeals or interferences which will directly affect or be directly affected by or have a bearing on the decision of the Board of Patent Appeals and Interferences ("the Board") in the pending appeal.

III. Status Of Claims

Claims 1-79 are pending in this application. Claims 1-79 as set forth in the Claims Appendix have been finally rejected under 35 U.S.C. § 103(a) in the final Office Action mailed December 13, 2005 ("Final Office Action"¹), and the rejections of those claims are at issue in this appeal.

IV. Status Of Amendments

No amendments under 37 C.F.R. § 1.116 have been filed subsequent to or in response to the Final Office Action.

¹ The Final Office Action contains a number of statements reflecting characterizations of the references cited by the Examiner and the claims. Regardless of whether any such statement is identified herein, Appellants decline to automatically subscribe to any statement or characterization in the Final Office Action.

V. Summary Of Claimed Subject Matter

A. Claim 1

The subject matter set forth in claim 1 relates to an apparatus for treating a volume of fluid (20a).² (¶ 20, pp. 5-6, FIGS. 1A-B.) The apparatus for treating a volume of fluid (20a) comprises a fluid passageway (36) through which the fluid flows, at least one source of irradiation (34), external to the fluid passageway (36), and at least two reflecting troughs (22, 24), each trough having a curved cross section, with a closed end, top (22a, 24a) and bottom (22b, 24b) edges, and an open end. (¶¶ 21, 23, pp. 6-7, FIGS. 1A-B.) The open end of each trough has first (22c, 24c) and second (22d, 24d) end edges, and the open end of the first trough faces the open end of the second trough to define a space between the closed ends of said troughs. (¶ 21, p. 6, FIGS. 1A-B.) In addition, the top (22a, 24a) edges of the first and second troughs (22, 24) define a first plane, and the bottom (22b, 24b) edges of the first and second troughs (22, 24) define a second plane (¶ 21, p. 6, FIG. 1B). Furthermore, a first set of reflectors (26, 28) joins the end edges of the first trough (22c, 22d) to the end edges of the second trough (24c, 24d), each reflector of the first set of reflectors (26, 28) having a top edge lying substantially in the first plane and a bottom edge lying substantially in the second plane. (¶ 22, p. 6, FIG. 1B.) Further still, a second set of reflectors (30, and a reflector not shown) joins the top edges of the troughs (22, 24) and the first set of reflectors (26, 28),

² The references to the specification and drawings in this Appeal Brief are intended to merely facilitate explaining how the originally-filed application provides exemplary embodiments and exemplary disclosure relating to the claimed subject matter. Those references should not be construed as limiting the scope of any of the claims or be considered to be necessarily exhaustive.

and also joins the bottom edges of the troughs (22, 24) and the first set of reflectors (26, 28), where the second set of reflectors (30, and a reflector not shown) cooperate with the troughs (22, 24) and the first set of reflectors (26, 28) to define a substantially enclosed chamber having at least one source of irradiation (34) therein and having the fluid passageway passing therethrough (36). (¶¶ 22-23, pp. 6-7, FIGS. 1A-B.)

Moreover, each source of irradiation (34) is within a respective one of the troughs (22, 24), and at least one of the fluid passageway (36) and at least one source of irradiation (34) is spaced from all focal axes of the troughs (22, 24) so as to provide a substantially uniform irradiation distribution within the fluid in the fluid passageway (36). (¶ 24, pp. 7-8).

VI. Grounds Of Rejection To Be Reviewed On Appeal

Claims 1-4, 11-22, 27-29, 35, 40-42, and 69-79 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of U.S. Patent No. 6,590,217 B1 to *Freeman et al.* (hereinafter “the ’217 *Freeman* patent”) and U.S. Patent No. 6,626,561 B2 to *Carter et al.* (hereinafter “the ’561 *Carter* patent”).

Claims 5-10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the ’217 *Freeman* patent and the ’561 *Carter* patent in view of U.S. Patent No. 5,136,491 to *Kano* (hereinafter “the ’491 *Kano* patent”) and further in view of U.S. Patent No. 6,083,387 to *LeBlanc et al.* (hereinafter “the ’387 *LeBlanc* patent”).

Claims 23-26, 30-34, 36-39, 43-68, 71, and 72 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of the ’217 *Freeman* patent, the ’561 *Carter* patent, the ’491 *Kano* patent, and the ’387 *LeBlanc* patent.

VII. Argument

A. Overview

The rejection of all pending claims 1-79 is premised—in whole or in part—on the combination of the '217 *Freeman* patent and the '561 *Carter* patent.³

Claim 1 is the only independent claim rejected under § 103(a) based on the '217 *Freeman* patent and the '561 *Carter* patent and Appellants respectfully submit that the § 103(a) rejection of independent claim 1 should be reversed because the Final Office Action fails to establish a case of *prima facie* obviousness. Put simply, there is no suggestion or motivation to modify the '217 *Freeman* patent in the Examiner's proposed, hypothetical manner based on the '561 *Carter* patent to solve a "fundamental problem" at least because the Examiner has improperly fabricated a "fundamental problem" from Appellants' own disclosure. It is well-settled that "[d]efining the problem in terms of its solution reveals improper hindsight in the selection of the prior art relevant to obviousness." *Monarch Knitting Mach. Corp. v. Sulzer Morat GmbH*, 139 F.3d 877, 881 (Fed. Cir. 1998). Accordingly, the rejection of claim 1 cannot be sustained. Similarly, for at least this reason, the Examiner's rejection of dependent claims 2-79 cannot be sustained.

Furthermore, the disclosure of the '217 *Freeman* patent teaches against any combination with the '561 *Carter* patent as suggested by the Examiner. In particular,

³ For example, the rejection of pending claims 1-4, 11-22, 27-29, 35, 40-42, and 69-79 is premised on the combination of the '217 *Freeman* patent and the '561 *Carter* patent alone. The rejection of the remaining pending claims 5-10, 23-26, 30-34, 36-39, and 43-68 and claims 71 and 72 is premised on the combination of the '217 *Freeman* patent and the '561 *Carter* patent in view of the '491 *Kano* patent and further in view of the '387 *LeBlanc* patent.

the disclosure of the '217 *Freeman* patent teaches against the use of lamp de-focusing. Accordingly, for at least this additional reason, the rejection of claims 1-79 cannot be sustained.

Further still, the deficiencies in the combination of the '217 *Freeman* patent and the '561 *Carter* patent are not cured by either the '491 *Kano* patent or the '387 *LeBlanc* patent or any of the other references cited by the Examiner as evidence allegedly showing motivation to arrange source and samples in an irradiation apparatus. Accordingly, the Examiner's rejection of all claims 1-79 cannot be sustained.

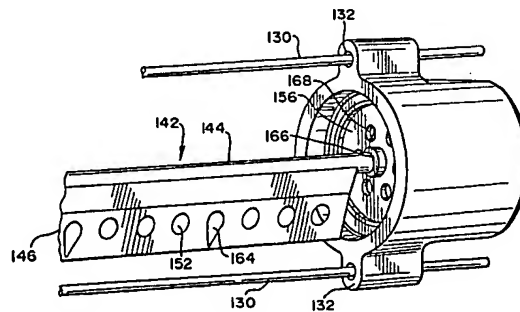
Further still, the combination of the '217 *Freeman* patent, the '561 *Carter* patent, the '491 *Kano* patent, and the '387 *LeBlanc* patent lacks the specified element relied upon the Examiner in fashioning the rejection of claims 8 and 9. Consequently, the Examiner's rejection of dependent claims 8 and 9 cannot be sustained for at least this additional reason.

Moreover, dependent claims 25, 26, 31, 39, 50, 57-59, 60-62, 72, and 74 recite additional elements not present in any of the disclosures of the '217 *Freeman* patent, the '561 *Carter* patent, the '491 *Kano* patent, and the '387 *LeBlanc* patents. Accordingly, the Examiner's rejection of claims 25, 26, 31, 39, 50, 57-59, 60-62, 72, and 74 cannot be sustained for at least this additional reason.

B. The art cited by the Examiner

1. The disclosure of the '217 Freeman patent

The '217 *Freeman* patent is directed to a system that incorporates a central wiper (142) to clean the inside surface of a fluid chamber, where the fluid in the chamber (and, more particularly, water) is irradiated by ultraviolet ("UV") light:



(the '217 *Freeman* patent, FIG. 3, Abstract lines 1-4).

The only portions of the written description in the '217 *Freeman* patent that disclose the position of UV lamps and that pertain to the transmission of UV energy to the fluid being irradiated are Col. 2/line 65–Col. 3/line 14; Col. 4/lines 46-63; and Col. 6/lines 15-27, reproduced below (emphasis added):

One embodiment of the apparatus of the present invention provides irradiation of a fluid with UV light and includes a tubular body consisting of a UV-permeable material. The tubular body includes an inner surface defining a fluid chamber and open first and second ends for ingress and egress of the fluid through the fluid chamber. At least one UV radiation source is provided and is so arranged relative to the tubular body as to subject the chamber to the UV light. A wiper is centrally supported in said body for rotation therein, sized and shaped to contact the inner surface. First and second light baffles are positioned inside the tubular body adjacent respective first and second ends and define an irradiated section of the fluid chamber therebetween to prevent UV light penetration beyond the irradiated section of the fluid chamber while permitting the fluid to flow through the apparatus.

* * *

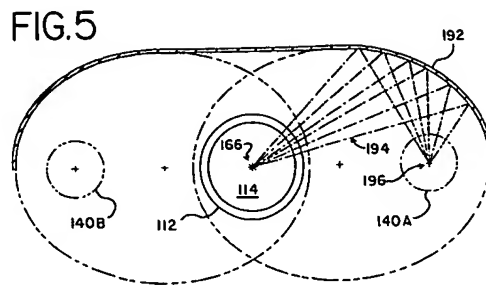
55 A UV radiation source 140 is arranged about the outside
 138 of the tubular body 112. The source 140, in the illus-
 trated embodiment, may include a pair of UV lamps 140A,
 140B designed to emit a high concentration or percentage of
 ultraviolet light. The UV lamps 140A, 140B are arranged to
 provide a maximum penetration of UV light through the
 tubular body 112 and ensure a maximum exposure of the
60 fluid 116 to the emitted UV radiation. The present invention
 contemplates providing any effective arrangement of UV
 light sources, which can be a single lamp or a plurality of
 lamps arranged about the tubular body 112.

* * *

15 An embodiment of the invention includes a plurality of
 high efficiency reflectors 192, (one is shown) formed in the
 illustrated embodiment shown in FIG. 5, of two symmetrical
 parts, which collect and focus scattered light emitted from
20 the lamps 140A, 140B to the center of the tubular body 112
 with the use of elliptical geometry. As shown, light rays 194,
 which originate from axial center 196 of lamp 140A are
 reflected to axial center 166 of tubular body 112, i.e., the
 axial center of the fluid chamber 114. In this manner, nearly
25 all of the emitted UV light from lamps 140A; 140B is used
 in irradiating fluid 116 in fluid chamber 114 of tubular body
 112.

According to its plain language, the disclosure in the '217 *Freeman* patent teaches the desirability of using "all of the emitted UV light" from the lamps (Col. 6/line 24), to provide the "maximum penetration of UV light" through fluid chamber 114, and "ensure maximum exposure of the fluid" (Col. 4/lines 57-60) to the UV light.

The arrangement of UV light sources taught by the '217 *Freeman* patent to irradiate the fluid in this manner is that depicted in FIG. 5



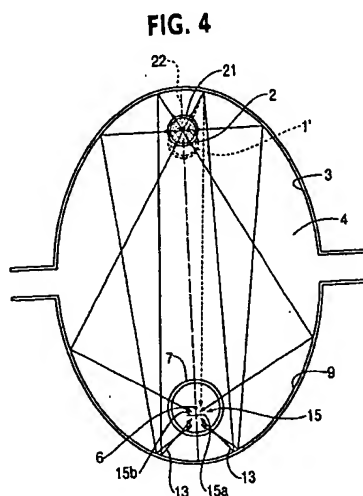
In FIG. 5 of the '217 *Freeman* patent, two sources of UV light are spaced on either side of the fluid chamber 114, where the UV light from each source is directly focused to the axial center of the fluid chamber 114 through the use of elliptical reflectors (192).

2. The disclosure of the '561 *Carter* patent

The '561 *Carter* patent is directed to providing increased uniformity of irradiation of both near and far surfaces of work pieces as set forth in Col. 5/lines 51-67 of the '561 *Carter* patent and elsewhere (emphasis added):

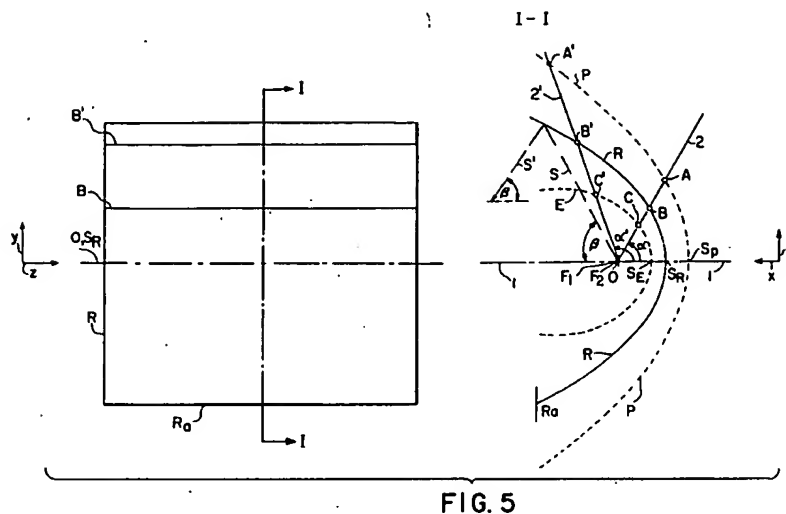
The present invention contemplates, as one aspect thereof, lamp structure including primary and secondary elliptical-shaped reflectors providing an elliptical space in which workpieces are irradiated with light generated from a bulb within the space, wherein the bulb is spaced, along the major axis of the elliptical space, from the first focal point but is positioned in the vicinity thereof (the workpieces being positioned in the vicinity of the second focal point), the bulb being centered along the major axis of the elliptical space. By displacing the bulb from the first focal point, uniformity of the radiation pattern is provided over a larger area (there is a larger distribution pattern), thereby providing more uniformity over surfaces of the workpieces. In addition, by displacement of the bulb as provided in the present invention, there is increased uniformity of irradiation of both the near and far surfaces of the workpieces (relative to the bulb). Thus, according to various aspects of the present invention, energy radiating from the bulb is dispersed more uniformly in the neighborhood of the workpieces.

The disclosure of the '561 *Carter* patent teaches the desirability of reducing the energy flux of UV light that directly strikes one side of a three-dimensional work piece, so as to increase (through secondary reflections or "twice reflected rays," Col. 6/lines 31-32) the amount of energy flux of UV light that strikes the opposite side of such a work piece (FIG. 4, and Col. 6/lines 28-35):



3. The disclosure of the '491 *Kano* patent

The '491 *Kano* patent is related to reflectors for lamps that are being used for "lighting a room, illuminating an object or also for coupling light into an optical waveguide" (Col. 1/lines 8-10). FIG. 5 of the '491 *Kano* patent, for example, is said to depict side and front views of a channel-shaped reflector (Col. 6/lines 2-4).



The channel-shaped reflector depicted in FIG. 5 above is said to be formed by a “reflector section curve R” that lies between a parabola “P” and an ellipse “E” (Col. 5/lines 38-44). Accordingly, the “reflector” disclosed in the '491 *Kano* patent “does not correspond to a conic section” (Col. 3/lines 2-4). Consequently, one skilled in the art would appreciate that the reflector R disclosed in the '491 *Kano* patent does not correspond to any second-order curve.

4. The disclosure of the '387 *LeBlanc* patent

The '387 *LeBlanc* patent “relates to apparatus and methods for the disinfection of fluids” (Abstract/lines 1-2). The disclosure of '387 *LeBlanc* patent emphasizes the importance of positioning UV lamps 103 and reflectors 102 “so as to maximize exposure of the fluid in tube 104 to the available radiation.” (Col. 10/lines 2-5, and FIG. 1, below):

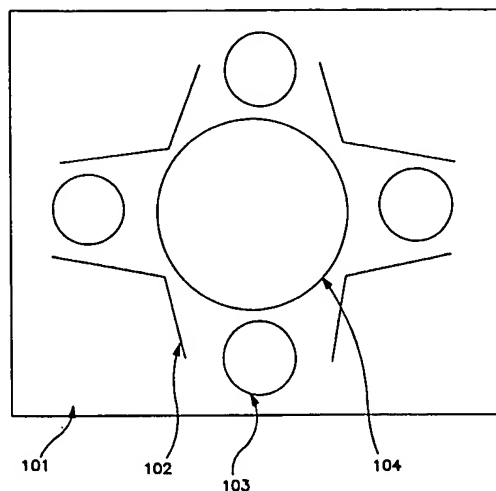


FIG. 1

5. Other art cited by the Examiner

In addition, the Examiner has cited (Final Office Action, pp. 6-8) various figures as :

[alleged] evidence that one skilled in the art would be motivated to rearrange the locations of sources and samples in an irradiation apparatus to optimize the intensity distribution in the sample;

Figure 2b in U.S. Patent No. 6,083,387;

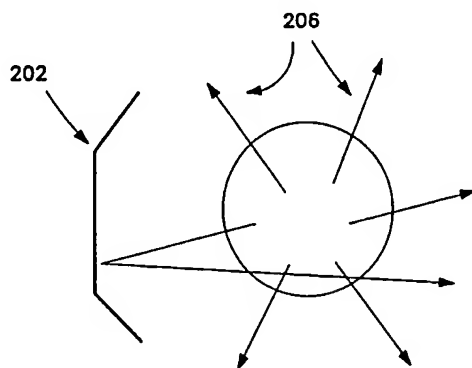
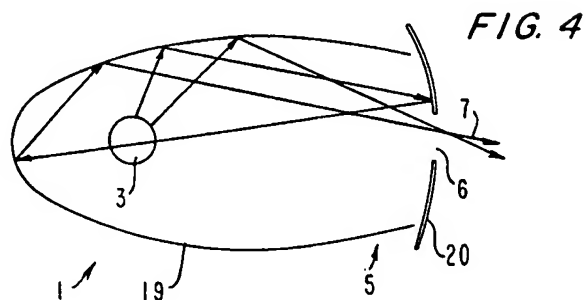
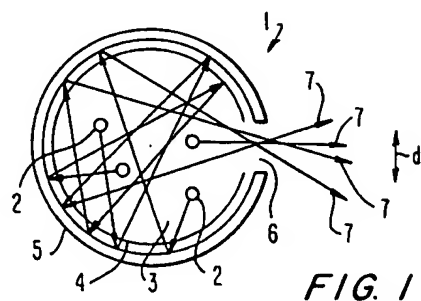


FIG. 2B

Figures 1 and 4 in U.S. Patent No. 5,989,283;



Figures 4 and 5 in U.S. Patent No. 4,694,179;

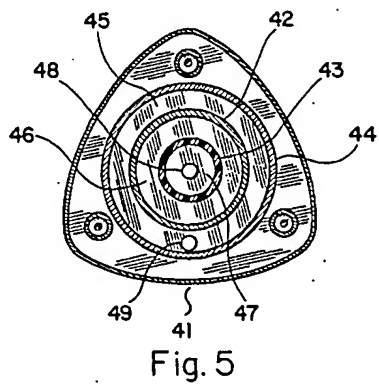
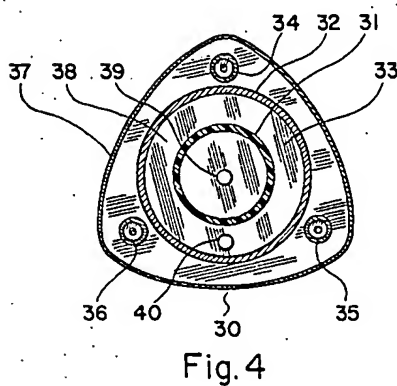


Figure 3 in U.S. Patent No. 6,707,048;

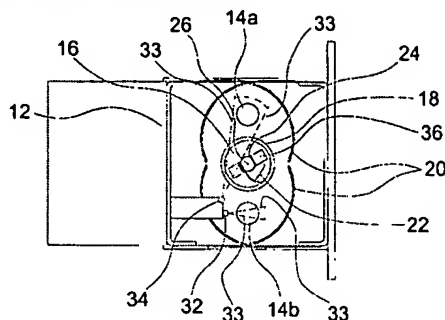


FIG. 3

As a point of clarification, Appellants note that the elements identified by the reference number “2” in Figure 1 of U.S. Patent No. 5,989,283 are, in fact, gas molecules (see Col. 5/lines 22-23 of U.S. Patent No. 5,989,283). Consequently, Appellants submit that one skilled in the art would conclude—at the least—that any teachings of FIG. 1 of U.S. Patent No. 5,989,283 do not bear on the issue of “the locations of sources and samples in an irradiation apparatus” as alleged by the Examiner.

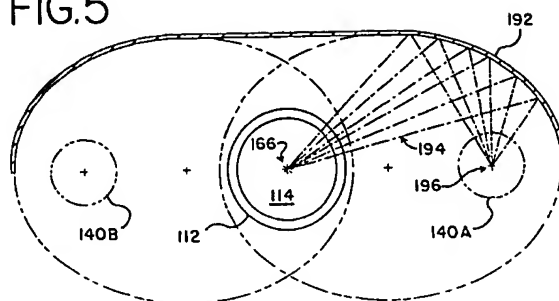
C. The Examiner’s rejection of claims 1-4, 11-22, 27-29, 35, 40-42, and 69-79 cannot be sustained

1. The Examiner’s rejection of independent claim 1 and dependent claims 2-4, 11-22, 27-29, 35, 40-42, and 69-79

In both the March 23, 2005, Office Action, and the Final Office Action, the Examiner has argued:

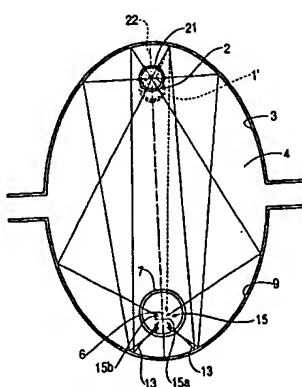
Freeman (217) discloses a UV sterilization unit having a tubular shaped irradiation chamber formed of plural reflectors 192 and plural tubular shaped lamps 140A and 140B, aligned longitudinally such that all UV energy is focused on the fluid passageway 112, as recited in claims 1-4, 11-17, 19, 20, 27, 72, and 74-79. See Column 2, line 65-67; Column 3, line 1014; Column 6, line 15-27; and Figure 5 below.

FIG. 5



Freeman (217) as applied above fails to teach placing the lamp in a position spaced apart from the focal axes of one of the troughs to provide a uniform irradiation distribution, as recited in claims 1, 18, 21, 22, 28, 29, 69-71, and 73. However, Carter (561) teaches defocusing the lamp within the reflector chamber to provide more uniformity of irradiation at the surface of the sample. See Column 3, line 3-9' Column 4, line 11-20; and Figure 4 below.

FIG. 4



Therefore, it would have been obvious to one of ordinary skill in the art that the UV sterilization apparatus and method of Freeman (217) can be modified to use the source defocusing method of Carter (561), to provide a lamp spaced from the first focal point of the reflector, thereby providing a more uniformly irradiated sample surface.

(Final Office Action, paragraph 4; also March 23, 2005, Office Action, paragraph 4).

2. To support an alleged motivation to modify the disclosure of the '217 *Freeman* with the teachings of the '561 *Carter* patent, the Examiner has improperly fabricated a "fundamental problem" from Appellants' own disclosure

To establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a), each of three requirements must be met. First, the reference or references, taken alone or combined, must teach or suggest each and every element recited in the claims (see M.P.E.P. § 2143 (8th ed. 2001, Rev. Aug. 2005)). Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to combine the references in a manner resulting in the claimed invention. Third, a reasonable expectation of success must exist. Moreover, each of these requirements must "be found in the prior art, and not be based on applicant's disclosure." See *id.*

Moreover, the burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). To establish a *prima facie* case, the Examiner must not only show that the combination includes all of the claimed elements, but also a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). With the foregoing in mind, Appellants respectfully assert that the instant claims are not obvious over the cited references taken alone or in combination.

a. The '217 *Freeman* patent is not concerned with irradiating a “sample surface” as alleged by the Examiner

In the above excerpt from the Final Office Action, the Examiner makes the conclusory statement “it would have been obvious to one of ordinary skill in the art that the UV sterilization apparatus and method of Freeman (217) can be modified to use the source defocusing method of Carter (561), to provide a lamp spaced from the first focal point of the reflector, thereby providing a more uniformly irradiated sample surface.” *Id.* (emphasis added).

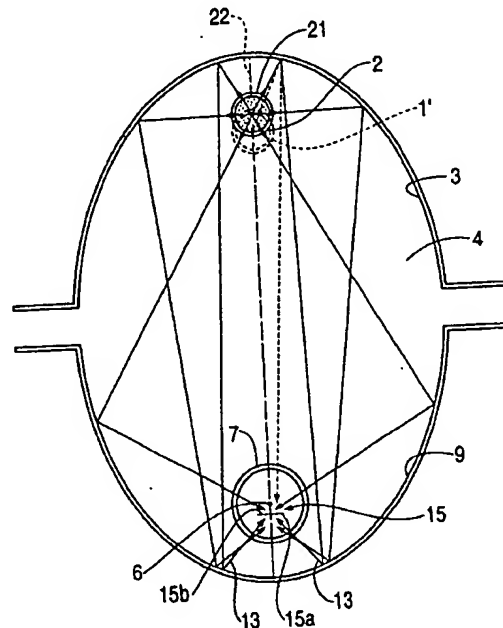
In contrast, Appellants note that the '217 *Freeman* patent does not disclose a “sample surface” to be irradiated, such as might be found on the “work piece” or ribbon 15 disclosed in the '561 *Carter* patent. Rather, the disclosure of the '217 *Freeman* patent is directed to a system where fluid in a chamber (and, more particularly, water) is irradiated by UV light. Significantly, it is not the surface of a work piece (or a ribbon 15) that is irradiated in the '217 *Freeman* patent, but the region within a fluid that is irradiated.

b. The '561 *Carter* patent is concerned with irradiating opposing sides of opaque work pieces

Similarly, the disclosure of the '561 *Carter* patent is not directed to the irradiation of fluid volumes as disclosed the '217 *Freeman* patent. Rather, the disclosure of the '561 *Carter* patent is directed to providing increased uniformity of irradiation on opposing surfaces of work pieces. Specifically, the technical problem set forth in the '561 *Carter* patent is the reduction of radiant energy incident on the side (15b) of a work piece (15) that faces a source of irradiation (21) (through direct and single-reflected

radiation), and an increase of radiant energy on the side (15a) of a work piece (15) that faces away from the source of irradiation (21) (through twice-reflected rays, as set forth at Col. 6/lines 33-35 of the '561 *Carter* patent).

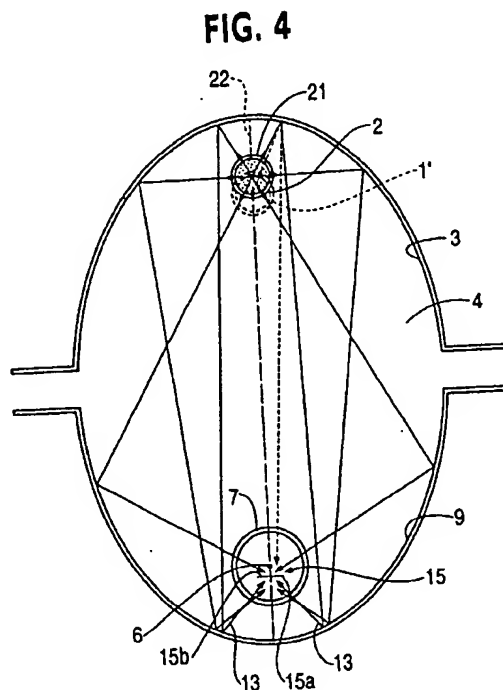
FIG. 4



Appellants' submit that one of ordinary skill in the art would appreciate that the work pieces of concern of the '561 *Carter* patent are opaque to the subject radiant energy. Moreover, the '561 *Carter* patent uses a particular phrase to describe the ratio of the energy incident on the "near surface" (15b) to the energy incident on the opposing surface (15a). Specifically, the '561 *Carter* patent refers to this ratio as "depth of field" (Col. 7/lines 22-35).

$$\text{"depth of field"} = \frac{(\text{Energy incident on side } 15b)}{(\text{Energy incident on side } 15a)}$$

Further still, to the extent a “fundamental problem” is addressed in the '561 *Carter* patent, the problem is that of increasing the energy incident on side 15a versus the energy incident on side 15b (in FIG. 4 below) when “tubular lamps” are used as a source of irradiation (21):



Also shown in end reflector 32 in FIG. 8 are two holes 33, 35 provided in end reflector 32. Hole 33 is provided at the first focal point, and hole 35 is provided displaced therefrom. According to the present invention, the bulb can be supported by hole 35, for positioning the bulb with its center displaced from first focal point 2. Thus, in being supported by hole 35, the bulb is located a little closer to the back of reflector 3, which provides a little more energy coupled to the bulb than when the bulb is at the conventional position (that is, supported by hole 33). With use of the end reflector and location of the bulb a little closer to that of the reflector,

irradiance at focus is reduced, but is increased in the far field. This is an improvement to the "depth of field" (a term for the ratio of energy getting to the near surface versus a farther surface). Thus, the present structure provides non-focused energy in the near-field (surface of the fiber or ribbon closest to the bulb) and enhanced irradiation (illumination) in the far-field, to improve uniformity and improve effectiveness of the lamps. Through displacement of the bulb, especially together with the use of the end reflector, mid- to far-field irradiation and dose for three-dimension curing is improved, overcoming one of the fundamental problems in three-dimensional curing when using tubular lamps, which exhibits a serious fall-off of energy in the far-field (that is, far side of the fiber or ribbon relative to the bulb).

(FIG. 4, and Col. 7/lines 22-35 of the '561 *Carter* patent, emphasis added)

c. The '561 *Carter* patent does not address any alleged problem associated with the '217 *Freeman* patent

As noted above, the '561 *Carter* patent is directed to providing increased uniformity of irradiation of both near and far surfaces of work pieces as set forth in Col. 5/lines 51-67 of the '561 *Carter* patent and elsewhere (emphasis added):

The present invention contemplates, as one aspect thereof, lamp structure including primary and secondary elliptical-shaped reflectors providing an elliptical space in which workpieces are irradiated with light generated from a bulb within the space, wherein the bulb is spaced, along the major axis of the elliptical space, from the first focal point but is positioned in the vicinity thereof (the workpieces being positioned in the vicinity of the second focal point), the bulb being centered along the major axis of the elliptical space. By displacing the bulb from the first focal point, uniformity of the radiation pattern is provided over a larger area (there is a larger distribution pattern), thereby providing more uniformity over surfaces of the workpieces. In addition, by displacement of the bulb as provided in the present invention, there is increased uniformity of irradiation of both the near and far surfaces of the workpieces (relative to the bulb). Thus, according to various aspects of the present invention, energy radiating from the bulb is dispersed more uniformly in the neighborhood of the workpieces.

One skilled in the art would appreciate that the disclosure of the '561 *Carter* patent teaches the desirability of reducing the energy flux of UV light that directly strikes one side of a three-dimensional work piece, so as to increase (through secondary reflections or "twice reflected rays," Col. 6/lines 31-32) the amount of energy flux of UV light that strikes the opposite side of such a work piece (FIG. 4, and Col. 6/lines 28-35).

Conversely, the '217 *Freeman* patent is directed to a system where fluid in a chamber (and, more particularly, water) is irradiated by UV light. Significantly, it is not the surface of a work piece (or a ribbon 15) that is irradiated in the '217 *Freeman* patent, but the region within a fluid. Consequently, for at least this reason, the Examiner has not shown that the '561 *Carter* patent addresses any alleged problem associated with the '217 *Freeman* patent.

- d. **Despite the fact that the '561 *Carter* patent does not address any alleged problem associated with the '217 *Freeman* patent, the Examiner, without support, suggests that quartz tube 7 in the '561 *Carter* patent can accommodate a "liquid"**

Despite the above-noted deficiency in combining the '561 *Carter* patent and the '217 *Freeman*, the Examiner states (Final Office Action, pp. 12-13, emphasis added):

The examiner has interpreted from the applicant's claims above and the Carter (561) references above, that adjusting the position of the source away from the focal point of the reflector is performed by both the applicant and Carter (561) to obtain the same result: i.e., to provide uniform irradiation distribution of the sample, which is governed by the same fundamental principle of optics, "depth of field". In fact, Carter (561) uses defocusing to eliminate the disadvantages produced by non-uniformity of irradiation at the sample surface. Thus the teaching of Carter (561) is applicable to providing uniformity of radiation for any material passing through the sample passageway (quartz tube 7), solid or liquid, and is therefore analogous art.

In the above statement, the Examiner not only expresses an incorrect understanding of the phrase “depth of field” as used in the '561 *Carter* patent, but also engages in speculation that the quartz tube 7 in the '561 *Carter* patent can accommodate a “liquid.”

With respect to the phrase “depth of field,” the Examiner appears to be relying upon the following excerpt from the '561 *Carter* patent (Col. 7/lines 10-35, emphasis added):

Also shown in end reflector 32 in FIG. 8 are two holes 33, 10
35 provided in end reflector 32. Hole 33 is provided at the
first focal point, and hole 35 is provided displaced there-
from. According to the present invention, the bulb can be
supported by hole 35, for positioning the bulb with its center
displaced from first focal point 2. Thus, in being supported 15
by hole 35, the bulb is located a little closer to the back of
reflector 3, which provides a little more energy coupled to
the bulb than when the bulb is at the conventional position
(that is, supported by hole 33). With use of the end reflector
and location of the bulb a little closer to that of the reflector,
irradiance at focus is reduced, but is increased in the far 20
field. This is an improvement to the “depth of field” (a term
for the ratio of energy getting to the near surface versus a
farther surface). Thus, the present structure provides non-
focused energy in the near-field (surface of the fiber or 25
ribbon closest to the bulb) and enhanced irradiation
(illumination) in the far-field, to improve uniformity and
improve effectiveness of the lamps. Through displacement
of the bulb, especially together with the use of the end
reflector, mid- to far-field irradiation and dose for three- 30
dimension curing is improved, overcoming one of the fun-
damental problems in three-dimensional curing when using
tubular lamps, which exhibits a serious fall-off of energy in
the far-field (that is, far side of the fiber or ribbon relative to
the bulb). 35

The Examiner takes this phrase “depth of field” as used above in the '561 *Carter* patent (described as a “ratio”) and—without explanation—casts it as a “fundamental principle of optics.” (Final Office Action, pp. 12-13.)

As noted above, however, the phrase “depth of field” in the ’561 *Carter* patent is used to refer to the ratio of the energy incident on the “near surface” (15b) to the energy incident on the opposing surface (15a) (Col. 7/lines 22-35):

$$\text{"depth of field"} = \frac{(\text{Energy incident on side 15b})}{(\text{Energy incident on side 15a})}$$

The Examiner has not explained how the ratio of radiant energy on opposing sides of an opaque work piece is a “fundamental principle of optics.” Furthermore, despite the Examiner’s speculation, Appellants note that nowhere in the ’561 *Carter* patent are the terms “liquid” or “fluid” used. More importantly, however, the Examiner fails to address how the ratio of radiant energy on opposing sides of an opaque work piece is a problem that might have been confronted by an inventor in the art of fluid or liquid treatment and sterilization before the inventions claimed in the present application were made.

For all of the above reasons, Appellants submit that the Examiner has failed to establish a *prima facie* case of obviousness. Specifically, the Examiner has failed to provide a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references as required. *Ex parte Clapp*, 227 U.S.P.Q. 971 (B.P.A.I. 1985).

- e. **The Examiner has repeatedly, and expressly, relied upon Appellants’ disclosure in combining the ’561 *Carter* patent and the ’217 *Freeman* patent**

In an apparent acknowledgement of the lack of any proper motivation to combine the references, the Examiner has repeatedly, and expressly, relied upon Appellants’

disclosure in finding a purported motivation or suggestion to combine the '561 *Carter* patent and the '217 *Freeman* patent. Specifically, the Examiner has repeatedly and expressly filled the gap in the teachings between the '561 *Carter* patent and the '217 *Freeman* patent by freely citing to Appellant's claims and disclosure.

For example, in Appellants' September 22, 2005, Response to the March 23, 2005, Office Action, Appellants noted that the '561 *Carter* patent is directed to increased uniformity of irradiation of both near and far surfaces of work pieces as set forth in Col. 5/lines 51-67 of the '561 *Carter* patent and elsewhere. Appellants further noted that the consideration of achieving uniform surface irradiation for surface curing purposes is fundamentally different than the substantially uniform irradiation of a flowing fluid inside of a conduit to achieve uniform irradiation therein.

In answer to Appellants' September 22, 2005, Response, the Examiner cited Appellants' pending claims 21 and 69. (Final Office Action pp. 10-11.) The Examiner then argued (Final Office Action, pp. 12-13):

The examiner has interpreted from the applicant's claims above and the Carter (561) references above, that adjusting the position of the source away from the focal point of the reflector is performed by both the applicant and Carter (561) to obtain the same result: i.e., to provide uniform irradiation distribution of the sample, which is governed by the same fundamental principle of optics, "depth of field". In fact, Carter (561) uses defocusing to eliminate the disadvantages produced by non-uniformity of irradiation at the sample surface. Thus the teaching of Carter (561) is applicable to providing uniformity of radiation for any material passing through the sample passageway (quartz tube 7), solid or liquid, and is therefore analogous art.

In addition, one of ordinary skill in the art of irradiation chambers having primary and secondary elliptical shaped reflectors as used by Freeman (217) would be motivated to utilize the Carter (561) invention to overcome non-uniformity of irradiation at the sample, which according to Carter (561) is a fundamental problem associated with their use.

Appellants first note that, in the above assertion, the Examiner has failed to establish that the teachings of the '217 *Freeman* patent and the '561 *Carter* patent are from analogous arts. Rather, the Examiner has clarified in the Final Office Action that the Examiner's combination of the '217 *Freeman* patent and the '561 *Carter* patent is based upon the Examiner's assertion that Appellants' disclosure and the '561 Carter patent are from analogous arts :

The examiner has interpreted from the applicant's claims above and the Carter (561) references above, *that adjusting the position of the source away from the focal point of the reflector is performed by both the applicant and Carter (561) to obtain the same result: i.e., to provide uniform irradiation distribution of the sample, which is governed by the same fundamental principle of optics, "depth of field".*

(Final Office Action, pp. 12-13, emphasis added).

Appellants respectfully note that the inquiry is not whether the Appellants' disclosure and a reference relied upon under 35 U.S.C. § 103(a) are from analogous arts. Rather, the proper inquiry is whether the teachings of the '217 *Freeman* patent and the '561 *Carter* patent are from analogous arts. (See, for example, M.P.E.P. § 1504.03 (II)(A)(1) (8th ed. 2001, Rev. Aug. 2005) "[w]hen a modification to a basic reference involves a change in configuration, both the basic and secondary references must be from analogous arts.")

In this regard, significantly, the Examiner states that the '561 *Carter* patent and the '217 *Freeman* patent may be combined ***based upon teachings gleaned only from Appellants' claims*** (Final Office Action, pp. 12-13, emphasis added):

The examiner has interpreted from the applicant's claims above and the Carter (561) references above, *that adjusting the position of the source away from the focal point of the reflector is performed by both the applicant and Carter*

(561) *to obtain the same result*: i.e., to provide uniform irradiation distribution of the sample, which is governed by the same fundamental principle of optics, “depth of field”.

Further still, in the Advisory Action mailed April 18, 2006, the Examiner responds to the above deficiency in the Final Office Action—and maintains the rejection of claims 1-79—by repeating the reliance *upon the teachings gleaned only from Appellants’ disclosure*:

The [March 13, 2006, Reply] has been considered but does NOT place the application in condition for allowance because: In response to applicants argument regarding the examiners use of improper hindsight reasoning; the examiner has specifically taken into account only knowledge which was within the level of ordinary skill in the art at the time the invention was made, by particularly pointing out that the applicants disclosure, in concert with the cited prior art each contain knowledge of the basic optical principles utilized by one of ordinary skill in the art of reflector shapes and surfaces used to provide a desired light flux at a desired location; for example the UV sterilization art. In so doing the examiner has attempted to point out that one of ordinary skill in the subject art would necessarily understand defocusing principles in order to disclose focusing principles, and vice versa.

(April 18, 2006, Advisory Action, p. 2, emphasis added)

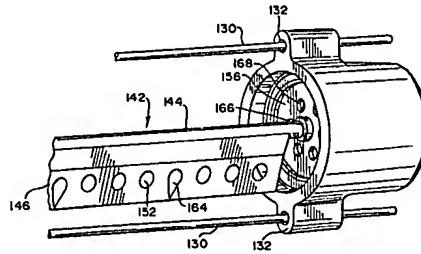
In view of the express—and repeated—reliance upon Appellants’ disclosure, Appellants respectfully submit that the rejections genuinely (and improperly) rely upon Appellants’ claims and disclosure in fashioning a rejection over the cited prior art under 35 USC § 103.

For at least the above reasons, the Examiner’s rejection of independent claim 1 cannot be sustained by the Board. Moreover, the Examiner’s rejection of dependent claims 2-4, 11-22, 27-29, 35, 40-42, and 69-79 (which also stand rejected under

35 U.S.C. § 103(a) over the sole combination of the '217 *Freeman* patent and the '561 *Carter* patent) also cannot be sustained by the Board.

f. The '217 *Freeman* patent teaches away from the use of lamp de-focusing

Furthermore, Appellants submit that the '217 *Freeman* patent teaches away from the use of lamp de-focusing—which is relied upon by the Examiner in fashioning the rejection. Appellants first note that the '217 *Freeman* patent is directed to a system that incorporates a central wiper (142) to clean the inside surface of a fluid chamber, where the fluid in the chamber (and, more particularly, water) is irradiated by UV light:



As previously noted, the only portions of the written description in the '217 *Freeman* patent that disclose the position of UV lamps and that pertain to the transmission of UV energy to the fluid being irradiated are Col. 2/line 65–Col. 3/line 14; Col. 4/lines 46-63; and Col. 6/lines 15-27, reproduced below (emphasis added):

One embodiment of the apparatus of the present invention provides irradiation of a fluid with UV light and includes a

tubular body consisting of a UV-permeable material. The tubular body includes an inner surface defining a fluid chamber and open first and second ends for ingress and egress of the fluid through the fluid chamber. At least one UV radiation source is provided and is so arranged relative 5 to the tubular body as to subject the chamber to the UV light. A wiper is centrally supported in said body for rotation therein, sized and shaped to contact the inner surface. First and second light baffles are positioned inside the tubular body adjacent respective first and second ends and define an 10 irradiated section of the fluid chamber therebetween to prevent UV light penetration beyond the irradiated section of the fluid chamber while permitting the fluid to flow through the apparatus.

* * *

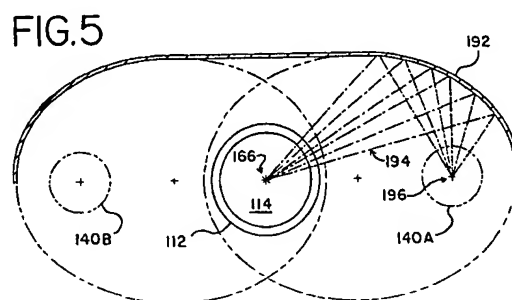
A UV radiation source 140 is arranged about the outside 138 of the tubular body 112. The source 140, in the illustrated embodiment, may include a pair of UV lamps 140A, 140B designed to emit a high concentration or percentage of ultraviolet light. The UV lamps 140A, 140B are arranged to provide a maximum penetration of UV light through the tubular body 112 and ensure a maximum exposure of the 55 fluid 116 to the emitted UV radiation. The present invention contemplates providing any effective arrangement of UV light sources, which can be a single lamp or a plurality of lamps arranged about the tubular body 112. 60

* * *

15 An embodiment of the invention includes a plurality of high efficiency reflectors 192, (one is shown) formed in the illustrated embodiment shown in FIG. 5, of two symmetrical parts, which collect and focus scattered light emitted from the lamps 140A, 140B to the center of the tubular body 112 20 with the use of elliptical geometry. As shown, light rays 194, which originate from axial center 196 of lamp 140A are reflected to axial center 166 of tubular body 112, i.e., the axial center of the fluid chamber 114. In this manner, nearly all of the emitted UV light from lamps 140A; 140B is used 25 in irradiating fluid 116 in fluid chamber 114 of tubular body 112.

Appellants submit that, according to the plain language, the disclosure in the '217 *Freeman* patent teaches, at most, the desirability of using "all of the emitted UV light" from the lamps (Col. 6/line 24), to provide the "maximum penetration of UV light"

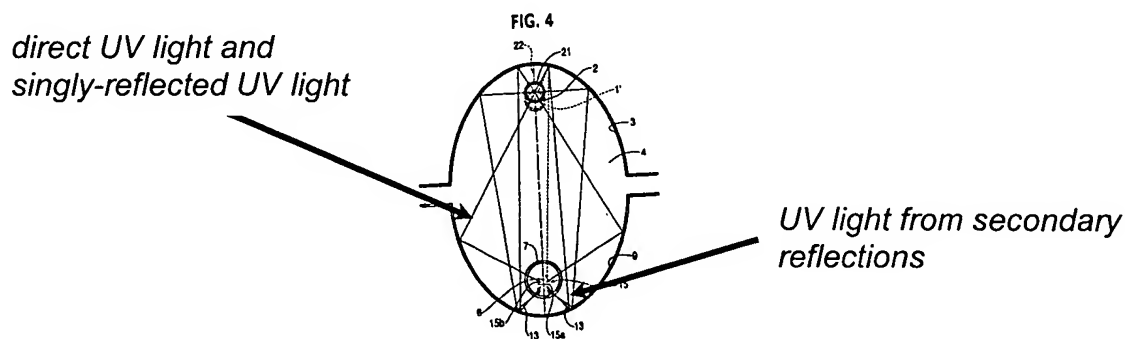
through fluid chamber 114, and “ensure maximum exposure of the fluid” (Col. 4/lines 57-60) to the UV light. The arrangement taught by the '217 *Freeman* patent to irradiate the fluid in this manner is that depicted in FIG. 5, which depicts two sources of UV light spaced on either side of the fluid chamber 114, and further where the UV light from each source is directly focused to the axial center of the fluid chamber 114 through the use of elliptical geometry:



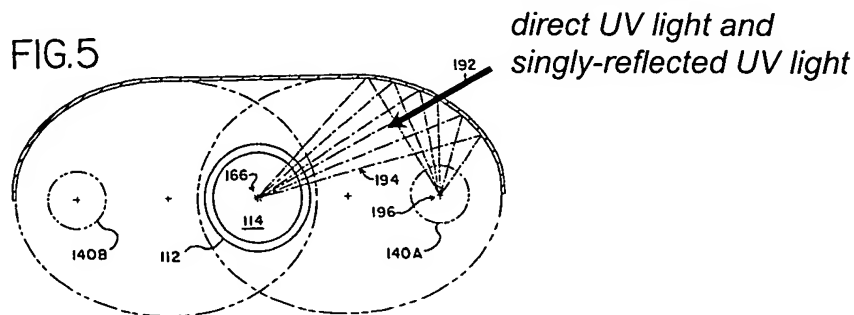
Significantly, the disclosure of the '217 *Freeman* patent does not expressly, inherently, or otherwise, rely upon secondary reflections (or “twice reflected rays”) to irradiate fluid chamber 114. In fact, Appellants submit that one skilled in the art would appreciate that the arrangement of the '217 *Freeman* patent corresponds to an irradiance pattern that is sharply peaked about the center of fluid chamber 114, and retains much of the original energy that is output by UV lamps 140A and 140B, thereby achieving the stated goal of using “all of the emitted UV light” from the lamps (Col. 6/line 24), to provide the “maximum penetration of UV light” through fluid chamber 114, and “ensure maximum exposure of the fluid” (Col. 4/lines 57-60) to the UV light.

In sharp contrast, the disclosure of the '561 *Carter* patent teaches the desirability of reducing the energy flux of UV light that directly strikes one side of a three-

dimensional work piece, so as to increase (through secondary reflections or “twice reflected rays,” Col. 6/lines 31-32) the amount of energy flux of UV light that strikes the opposite side of such a work piece. Appellants submit that one of ordinary skill in the art would appreciate this effect through FIG. 4 of the '561 *Carter* patent—relied upon by the Examiner (emphasis added):



Again, Appellants note that the '217 *Freeman* patent does not disclose, inherently or otherwise, the use of secondary reflections to provide UV light to fluid chamber 114. In contrast, the solution of the preferred embodiment in the '217 *Freeman* patent is to simply use two—easily replaceable—light sources, with each source spaced to either side of fluid chamber 114 (FIG. 5, emphasis added):



For at least the above reason, Appellants submit that one skilled in the art applying the disclosure the '217 *Freeman* patent would not be motivated by the '561

Carter patent to implement the defocusing of light sources 140A and 140B. Specifically, one skilled in the art would appreciate that the only effect of lamp de-focusing as taught in the '561 *Carter* patent on the arrangement disclosed in the '217 *Freeman* patent would be to decrease the maximum penetration of energy flux through fluid chamber 114.

Because the '217 *Freeman* patent teaches the desirability of the exact opposite effect (*i.e.*, using “all of the emitted UV light” from the lamps (Col. 6/line 24), to provide the “maximum penetration of UV light” through fluid chamber 114, and “ensure maximum exposure of the fluid” (Col. 4/lines 57-60) to the UV light), Appellants submit that the '217 *Freeman* patent teaches away from the use of lamp defocusing.

For at least this additional reason, Appellants submit that the rejection of claims 1-4, 11-22, 27-29, 35, 40-42, and 69-79 under 35 U.S.C. § 103(a) should be reversed.

D. The Examiner's rejection of all pending claims 1-79 cannot be sustained

1. The deficiencies in the combination of the '217 *Freeman* patent and the '561 *Carter* patent are not cured by either the '491 *Kano* patent or the '387 *LeBlanc* patent

Further still, Appellants respectfully submit that the Examiner's rejection of claims 5-10 under 35 U.S.C. § 103(a) as being unpatentable over the '217 *Freeman* patent and the '561 *Carter* patent in view of the '491 *Kano* patent, and further in view of the '387 *LeBlanc* patent cannot be sustained. Likewise, Appellants respectfully submit that the Examiner's rejection of claims 23-26, 30-34, 36-39, 43-68, 71, and 72 under 35 U.S.C. § 103(a) as being unpatentable over the combination of the '217 *Freeman* patent, the

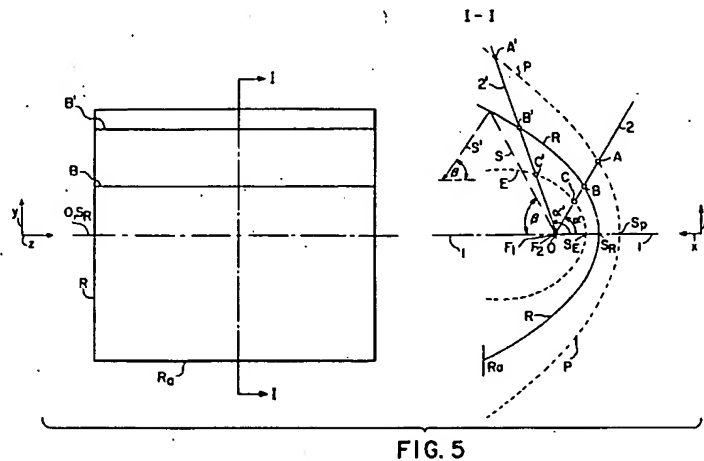
'561 *Carter* patent, the '491 *Kano* patent, and the '387 *LeBlanc* patent cannot be sustained.

To begin with, Appellants note that the deficiencies in the combination of the '217 *Freeman* patent and the '561 *Carter* patent are not cured by either the '491 *Kano* patent or the '387 *LeBlanc* patent.

With regard to the '491 *Kano* patent, the Examiner has stated (Final Office Action, paragraph 5, pp. 4-5):

The combination of Freeman (217) and Carter (561) fails to teach the use of the reflector shapes recited in claim 5-7, and 10. However Kano (491) discloses the use of elliptical, parabolic and segmented reflector shapes, as recited in claims 5-7, and 10. See Column 1, line 10-16; Column 6, line 1-14; and Figure 5 below.

Therefore, it would have been obvious to one of ordinary skill in the art that the UV sterilization apparatus and method of Freeman (217), and Carter (561), can be modified to use the reflector shaping method of Kano (491), to provide various reflector forms, but also providing the lamp designer with a method enabling him to design an optimum reflector form in dependence upon the given marginal conditions for the lamp and the desired light distribution.



Likewise, with regard to or the '387 *LeBlanc* patent, the Examiner has stated (Final Office Action, paragraph 5, p. 5):

The combination of Freeman (217), Carter (561), and Kano (491) fails to teach the use of a V shaped reflector, as recited in claims 8 and 9. However LeBlanc (387) teaches the use of a V shaped reflector. See Figure 1 below.

Therefore it would have been obvious to one of ordinary skill in the art that the sterilization apparatus and method of Freeman (217), carter (561), and Kano (491) can be modified to use the V shaped reflector of LeBlanc (387), to provide fluid exposure to the radiation that can be optimized by creating an orientation pattern of UV lamps around the tubing with ultraviolet reflective surfaces directing the radiation toward the fluid.

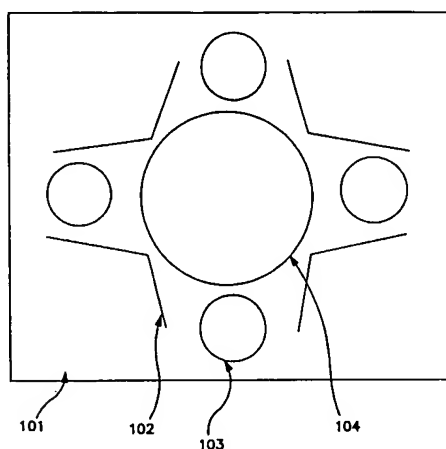


FIG. 1

Without subscribing to the Examiner's characterizations of the '491 *Kano* patent and the '387 *LeBlanc* patent, Appellants respectfully submit that the disclosure of the '491 *Kano* patent and the disclosure of the '387 *LeBlanc* patent are both devoid of any suggestion, inherently or otherwise, of any advantage to reducing the energy flux of direct and singly-reflected UV light (as suggested by the '561 *Carter* patent) on a fluid volume as is configured in the '217 *Freeman* patent.

Rather, the '491 *Kano* patent is related to reflectors for lamps that are being used for "lighting a room, illuminating an object or also for coupling light into an optical waveguide" (Col. 1/lines 8-10). Similarly, while the '387 *LeBlanc* patent "relates to

apparatus and methods for the disinfection of fluids" (Abstract/lines 1-2), the disclosure of '387 *LeBlanc* patent emphasizes the importance of positioning UV lamps 103 and reflectors 102 "so as to maximize exposure of the fluid in tube 104 to the available radiation." (Col. 10/lines 2-5, and FIG. 1, below):

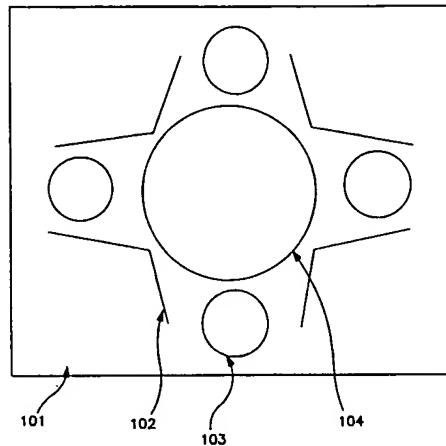


FIG. 1

Accordingly, Appellants submit that the deficiency in the combination of the '217 *Freeman* patent and the '561 *Carter* patent is not cured by the disclosure of either the '491 *Kano* patent or the '387 *LeBlanc* patent. For at least this reason, Appellants submit that the Examiner has not made a *prima facie* case for the obviousness of claims 5-10, 23-26, 30-34, 36-39, 43-68, 71, and 72 under 35 U.S.C. § 103(a), and respectfully submit that the rejection of claims 5-10, 23-26, 30-34, 36-39, 43-68, 71, and 72 under 35 U.S.C. § 103(a) should be reversed.

2. **The Examiner's rejection of claims 5-10, 23-26, 30-34, 36-39, 43-68, 71, and 72 under the proposed combination of the '217 *Freeman* patent and the '491 *Kano* patent cannot be sustained**
 - a. **The Examiner's proposed combination of the '217 *Freeman* patent and the '491 *Kano* patent would render the '491 *Kano* patent unsatisfactory for its intended use**

Further still, although the Examiner relies upon the '491 *Kano* patent to teach, for example, a parabolic reflector shape as recited in claim 5 (*see, for example*, the Final Office Action, paragraph 5, p. 4.), Appellants remind the Board that a proposed modification of a prior art teaching cannot render the prior art unsatisfactory for its intended use (see M.P.E.P. § 2143.01 (8th ed. 2001, Rev. Aug. 2005)).

In this regard, Appellants respectfully submit that any proposed combination of the '217 *Freeman* patent and the '491 *Kano* patent attempting to satisfy the claim recitations relating to a "second order curve" renders the teachings of the '491 *Kano* patent unsatisfactory for its intended use. Significantly, Appellants note that the "reflector" disclosed in the '491 *Kano* patent "does not correspond to a conic section" (Col. 3/lines 2-4). Consequently, one skilled in the art would appreciate that the reflector R disclosed in the '491 *Kano* patent does not correspond to any second-order curve, as recited in claims 5-10, 23-26, 30-34, 36-39, 43-68, 71, and 72.

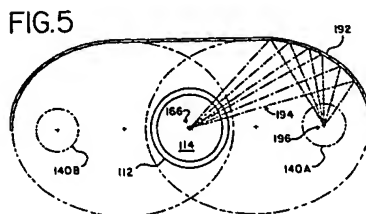
In this regard, the '491 *Kano* patent repeatedly emphasizes the significance of the reflection properties of the disclosed reflector R from that of conic section reflectors. See, for example, (i) Col. 3/lines 5-8: "[t]he reflection properties of reflectors designed according to the invention are fundamentally different from the reflection properties of

conic section reflectors ...”; (ii) Col. 3/lines 36-41 (emphasis added): “[w]ith the teaching according to the invention, ... [t]he condensing [of radiation with high efficiency onto a single point] is better than that achieved with a paraboloidal reflector.”

For at least the above reasons, the Examiner’s proposed modification of the ’217 *Freeman* patent to use “elliptical, parabolic and segmented reflector shapes” (Final Office Action, paragraph 5, p. 4) renders the disclosure of the ’491 *Kano* patent unfit for its intended use. Accordingly, the rejection of claims 5-10, 23-26, 30-34, 36-39, 43-68, 71, and 72 cannot be sustained for at least this additional reason.

b. The ’217 *Freeman* patent teaches against any combination with the ’491 *Kano* patent as proposed by the Examiner

Furthermore, Appellants submit that the ’217 *Freeman* patent teaches against any combination with the ’491 *Kano* patent as proposed by the Examiner. As Appellants have noted, the disclosure in the ’217 *Freeman* patent teaches, at most, the desirability of using “all of the emitted UV light” from the lamps (Col. 6/line 24), to provide the “maximum penetration of UV light” through fluid chamber 114, and “ensure maximum exposure of the fluid” (Col. 4/lines 57-60) to the UV light. To achieve this result, the ’217 *Freeman* patent relies upon the “use of elliptical geometry” (Col. 6/line 20). Appellants submit that one skilled in the art would appreciate that FIG. 5 of the ’217 *Freeman* patent illustrates such an application of “elliptical geometry” as evidenced by the dashed lines superimposed on reflectors 192:



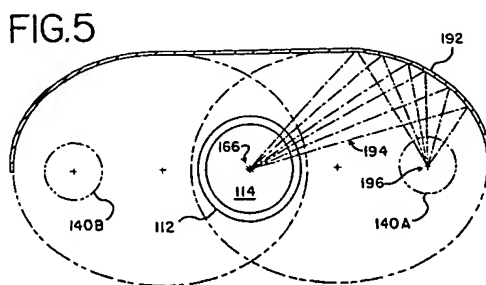
Such an understanding of the use of “elliptical geometry” is echoed in the '491 *Kano* patent (Col. 1/lines 20-27, emphasis added):

a) Ellipse

20

The ellipse is, defined by two parameters, that is the major semiaxis a and the minor semiaxis b. Rays emanating from a focal point of the ellipse are reflected by the ellipsoid reflector so that they are condensed at the other focal point, the rays thereafter being propagated with a relatively large angle.

In contrast, however, the Examiner improperly relies upon the '491 *Kano* patent to teach, for example, a parabolic reflector shape as recited in claim 5. (See, for example, the Final Office Action, paragraph 5, p. 4.) Appellants submit, however, that one of ordinary skill in the art would appreciate that a parabolic reflector shape, or any shape other than an ellipse, will not directly focus light to a focal point as is required for operation of the apparatus in the '217 *Freeman* patent:



Rather, a parabolic reflector shape will redirect rays emanating from a focal point so that they are completely parallel. Such an understanding of parabolic reflector

shapes, as well as hyperbolic reflector shapes is set forth in the '491 *Kano* patent (Col. 1/lines 28-42, emphasis added):

b) Parabola

The parabola is defined by one parameter (usually 30 denoted "p"). Rays emanating from the focal point of the paraboloid are reflected by the reflector in such a manner that they run parallel to the optical axis.

c) Hyperbola

35

The hyperbola is defined by two parameters, the real semiaxis a and the imaginary semiaxis b. Rays emanating from the focal point are reflected so that they move away from the optical axis. The spreading of the rays is a function of the distance from the optical axis; the 40 nearer the ray to the optical axis the more acute the angle relative to the optical axis.

Consequently, Appellants submit that one skilled in the art would appreciate that the use of a parabolic reflector shape as the Examiner alleges is taught in the '491 *Kano* patent runs completely counter to the stated goal of the '217 *Freeman* patent, which teaches the desirability of using "all of the emitted UV light" from the lamps (Col. 6/line 24), to provide the "maximum penetration of UV light" through fluid chamber 114, and "ensure maximum exposure of the fluid" (Col. 4/lines 57-60) to the UV light. Accordingly, Appellants submit that the '217 *Freeman* patent teaches against any combination with the '491 *Kano* patent as proposed by the Examiner.

Consequently, for at least this additional reason, Appellants submit that the Examiner has not made a *prima facie* case for the obviousness of claims 5-10, 23-26, 30-34, 36-39, 43-68, 71, and 72 under 35 U.S.C. § 103(a), to the extent that the Examiner is relying on a combination of the '217 *Freeman* patent and the '491 *Kano* patent, and respectfully request that the rejection of claims 5-10, 23-26, 30-34, 36-39, 43-68, 71, and 72 under 35 U.S.C. § 103(a) be reversed.

E. The Examiner's rejection of claims 8, 9, 25, 26, 31, 39, 50, 57-59, 60-62, 72, and 74 cannot be sustained

1. The combination of the '387 *LeBlanc* patent, the '491 *Kano* patent, the '217 *Freeman* patent, and the '561 *Carter* patent lacks the specified element relied upon by the Examiner in fashioning the rejection of claims 8 and 9

Further still, Appellants note with respect to pending claims 8 and 9 that the Examiner has relied upon the combination of the '217 *Freeman* patent, the '561 *Carter* patent, the '491 *Kano* patent, and FIG 1 of the '387 *LeBlanc* patent:

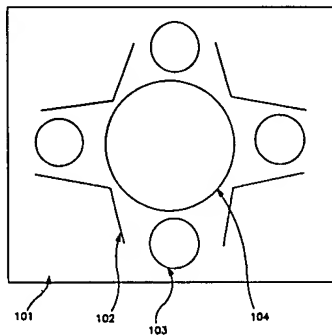


FIG. 1

Appellants respectfully submit that the Examiner's rejection cannot be sustained as the alleged combination—at the least—lacks the recited “first flat reflector” and “second flat reflector” in the recited relationship (emphasis added):

8. Apparatus according to claim 1, wherein each trough has a longitudinal axis, and wherein each reflector of said first set of reflectors is segmented and comprises:
 - a first flat reflector segment extending from a first one of said troughs at an angle to the longitudinal axis of such trough; and
 - a second flat reflector segment extending from a second one of said troughs at an angle to the longitudinal axis of that trough and cooperating with said first flat reflector segment to define a V substantially midway between said troughs.
9. Apparatus according to claim 8, wherein the V forms an angle of substantially 90°.

Appellants note that claim 1—upon which claims 8 and 9 depend—recites “at least two reflecting troughs” and further recites “the open end of the first trough facing the open end of the second trough to define a space between the closed ends of said troughs.” Appellants respectfully submit that the ‘387 *LeBlanc* patent is devoid, inherently or otherwise, of such a configuration of: first trough; second trough; first flat reflector segment; and second flat reflector segment. Specifically, Appellants submit that for any alleged first trough and first flat reflector segment that may be disclosed in the ‘387 *LeBlanc* patent, there is no “second trough” and “second flat reflector segment” such that the following claim elements (among other features) are satisfied: *(i)* that “the open end of the first trough fac[es] the open end of the second trough to define a space between the closed ends of said troughs,” and *(ii)* that the “first flat reflector segment” and “second flat reflector segment” “define a V substantially midway between said troughs.”

By way of example only, and intending merely to illustrate how the originally-filed application provides exemplary embodiments and exemplary disclosure relating to the claimed subject matter, FIGS. 5A and 5B of the present application illustrate an exemplary embodiment relating to the claimed subject matter of claims 8 and 9, and also illustrate how an exemplary embodiment of the subject matter of claims 8 and 9 is not disclosed in the ‘387 *LeBlanc* patent:

FIG. 5A

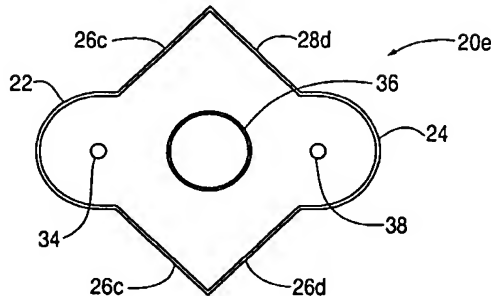
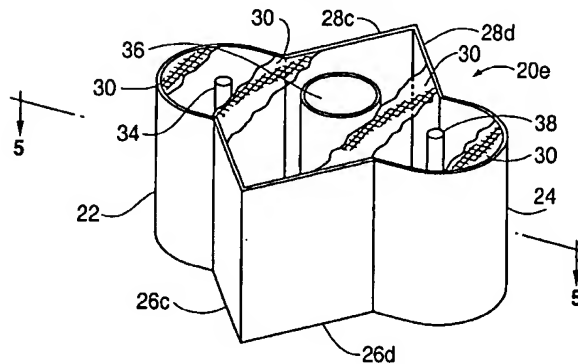


FIG. 5B



Consequently, for at least this additional reason, Appellants submit that the Examiner has not made a *prima facie* case for the obviousness of claims 8 and 9 under 35 U.S.C. § 103(a) and respectfully request that the rejection of claims 8 and 9 under 35 U.S.C. § 103(a) be reversed.

2. **Dependent claims 25, 26, 31, 39, 50, 57-59, 60-62, 72, and 74 recite additional elements not present in any of the '217 *Freeman* patent, the '561 *Carter* patent, the '491 *Kano* patent, or the '387 *LeBlanc* patent**

Further still, and without limitation, Appellants note that dependent claims 25, 26, 31, 39, 50, 57-59, 60-62, 72, and 74 recite additional elements not present in any of the '217 *Freeman* patent, the '561 *Carter* patent, the '491 *Kano* patent, or the '387 *LeBlanc* patent.

- a. **None of the references relied upon or figures cited by the Examiner depict the arrangement of longitudinal axes and troughs recited in claims 25, 26, 31, 39, 50, 72, and 75**

For example, claims 25 and 26 recite “wherein each trough has a longitudinal axis, and the longitudinal axes define a figure having a center of symmetry”; claims 31 and 39 recite “wherein said two troughs have non-coinciding longitudinal axes”; claim 50 recites “wherein said fluid passageway has a central axis passing through the center of symmetry of a figure defined by the points of intersection of the longitudinal axes of said troughs”; and claims 72 and 74 recite “wherein said at least one trough has a longitudinal axis and is shifted in a direction substantially perpendicular to the longitudinal axis of such trough.”

Appellants submit that claims 25, 26, 31, 39, 50, 72, and 74 recite arrangements of longitudinal axes and troughs that are not in any of the references relied upon by the Examiner. In contrast, the Examiner has cited (Final Office Action, pp. 6-8) various Figures as:

[alleged] evidence that one skilled in the art would be motivated to rearrange the locations of sources and samples in an irradiation apparatus to optimize the intensity distribution in the sample;

Figure 2b in U.S. Patent No. 6,083,387;

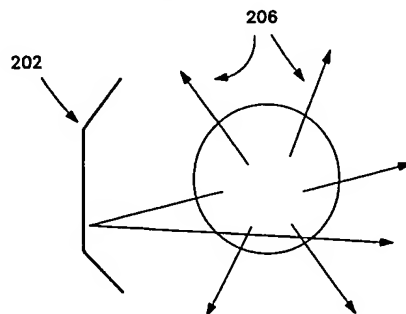
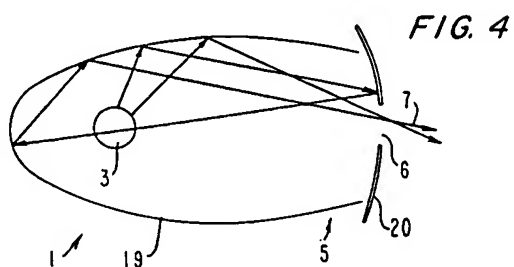
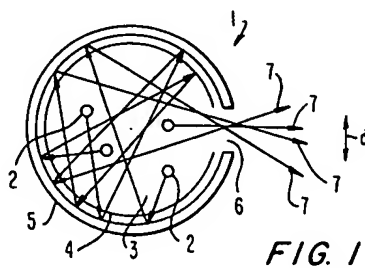


FIG. 2B

Figure's [sic] 1 and 4 in U.S. Patent No. 5,989,283;



Figure's [sic] 4 and 5 in U.S. Patent No. 4,694,179;

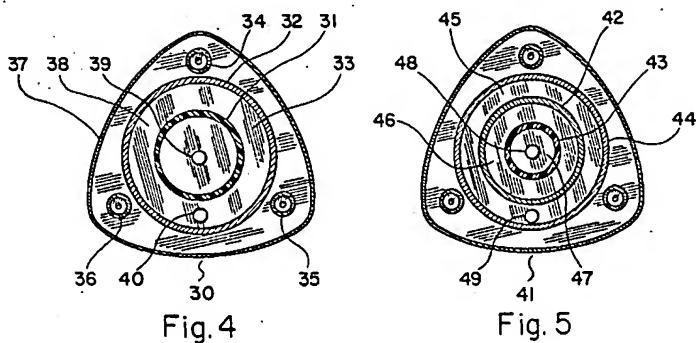


Figure 3 in U.S. Patent No. 6,707,048;

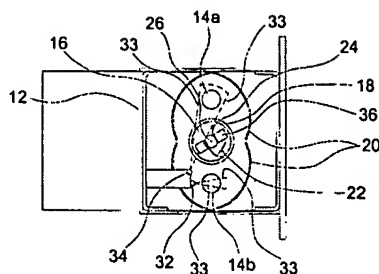
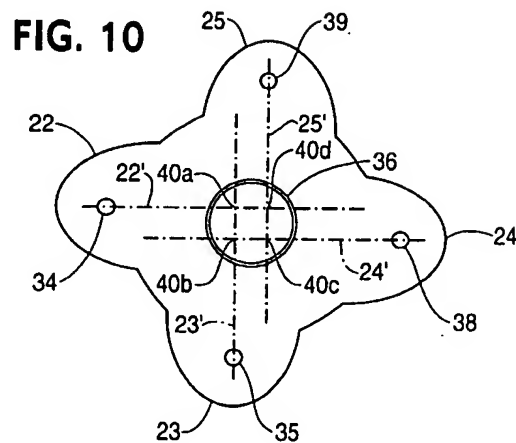


FIG. 3

Appellants submit that none of the references relied upon, or Figures cited by the Examiner depict, inherently or otherwise, among other features, the arrangement of longitudinal axes and troughs recited in claims 25, 26, 31, 39, 50, 72, and 74. For example, to the extent that any of the Figures above depict more than one reflector/radiation source arrangement, Appellants submit that the respective longitudinal axes of such plurality of reflector/radiation sources do not define a figure having a center of symmetry.⁴

Again, by way of example only, and intending merely to illustrate how the originally-filed application provides exemplary embodiments and exemplary disclosure relating to the claimed subject matter, FIG. 10 of the present application illustrates an exemplary embodiment relating to the claimed subject matter of claims 25, 26, 31, 39, 50, 72, and 74, and also illustrates how an exemplary embodiment of claims 25, 26, 31, 39, 50, 72, and 74 is not found in any of the Figures cited by the Examiner:

⁴ For avoidance of doubt, Appellants again note that the elements identified by the reference number "2" in Figure 1 of U.S. Patent No. 5,989,283 are, in fact, gas molecules (see Col. 5/lines 22-23).



Appellants note that an exemplary “figure of symmetry” is illustrated in FIG. 10 by the intersections 40a, 40b, 40c, and 40d (¶ 39, p. 12).

b. The '217 *Freeman* patent teaches against the adjustability as recited in claims 57-59 and 60-62

Further still, Appellants note that claims 57-59 and 60-62 recite “further comprising a mount for each trough, making the position of each trough adjustable.”

The Examiner has stated that

it would have been obvious to one having ordinary skill in the art at the time the invention was made to make adjustable, since it have [sic] been held that adjustability, where needed, involves only routine skill in the art. One would have been motivated to make the source mount, trough mount and fluid passageway adjustable for the purpose of changing the their [sic] respective positions to optimize the irradiation.

(Final Office Action, p. 9.)

Appellants respectfully note another aspect of the apparatus disclosed in the '217 *Freeman* patent that is indicated as desirable: namely the modular design of the apparatus and the ease with which the apparatus may be repaired. For example (Col 7/lines 35-57, emphasis added):

The embodiment shown in FIG. 17 illustrates the four³⁵ basic modules of the present invention and how the unit 210 is assembled. Back cover 214 may include tubular body 112 and other components associated with assembly 110. Inner cover 220 includes electrical components, such as ballast 240, electronics module 226, light sensor 222 including⁴⁰ sensor card 242 and the radiation sources 140 fastened thereto. The inner cover 220 is fastened to back cover 214. The front cover includes reflector 192 and is fastened over inner cover 220 to complete assembly of the unit. The order of assembly may be changed without changing the spirit of⁴⁵ the invention. Further, the specific arrangement of components of the unit may be changed into various configurations that contemplate the invention. It can be seen that replacement of any or more than one component of the unit 210 can be performed quickly by virtue of the modular design of the invention and lateral access thereto. It can be seen that⁵⁰
maintenance personnel need only detach the front cover 212 to access the radiation sources 140 and remove the radiation sources in a lateral direction. Removal of the inner cover 220 permits access to all of the electronic components 226, 242 and 240 and the remainder of the assembly 110 including the⁵⁵
tubular body 112, outlet and inlet 126, 128 and associated components.

Appellants submit that the disclosure of the '217 *Freeman* patent teaches against the adjustability proposed by the Examiner; one skilled in the art would appreciate that adjustability of any identified "trough" in the apparatus of the '217 *Freeman* patent does not follow from the expressly described "modular" design of such apparatus. Put simply, Appellants submit that one skilled in the art would appreciate that a hypothetical modification of the apparatus of the '217 *Freeman* patent to make it "adjustable" as alleged by the Examiner is not "routine," where the teachings of the '217 *Freeman* patent emphasize the apparatus' "modular" design.

Consequently, and in addition to the reasons described in detail above, Appellants maintain that the Examiner has not made a *prima facie* case for the obviousness of dependent claims 25, 26, 31, 39, 50, 57-59, 60-62, 72, and 74 under³⁵ U.S.C. § 103(a).

F. Conclusion

For at least the reasons set forth in detail above, the rejection of claims 1-79 under 35 U.S.C. § 103(a) should be reversed. However, if the Examiner and/or the Board wishes to resolve any other issues by way of a telephone conference, the Examiner and/or the Board is kindly invited to contact the undersigned attorney at the telephone number indicated below.

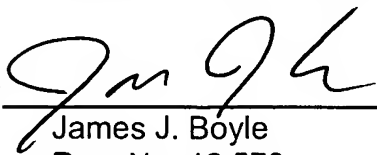
G. Any further extension of time that may be required, any additional fees that may be required

To the extent any further extension of time under 37 C.F.R. § 1.136 is required to obtain entry of this Appeal Brief, such extension is hereby respectfully requested. If there are any fees due under 37 C.F.R. §§ 1.16 or 1.17 which are not enclosed herewith, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: October 20, 2006

By: 
James J. Boyle
Reg. No. 46,570

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VIII. Claims Appendix

Claim 1 (original). Apparatus for treating a volume of fluid, said apparatus comprising:

- a fluid passageway through which the fluid flows;
- at least one source of irradiation, external to said fluid passageway;
- at least two reflecting troughs, each trough having a curved cross section, with a closed end, top and bottom edges, and an open end, the open end of each trough having first and second end edges, the open end of said first trough facing the open end of said second trough to define a space between the closed ends of said troughs, the top edges of said first and second troughs defining a first plane, and the bottom edges of said first and second troughs defining a second plane;
- a first set of reflectors joining the end edges of said first trough to the end edges of said second trough, each reflector of said first set of reflectors having a top edge lying substantially in the first plane and a bottom edge lying substantially in the second plane; and
- a second set of reflectors joining the top edges of said troughs and of said first set of reflectors and joining the bottom edges of said troughs and of said first set of reflectors, said second set of reflectors cooperating with said troughs and said first set of reflectors to define a substantially enclosed chamber having said at least one source of irradiation therein and having said fluid passageway passing therethrough, wherein:

each source of irradiation is within a respective one of said troughs, and at least one of said fluid passageway and said at least one source of irradiation is spaced from all focal axes of said troughs so as to provide a substantially uniform irradiation distribution within the fluid in said fluid passageway.

Claim 2 (original). Apparatus according to claim 1, wherein at least one of said troughs has a cross section defined by a plurality of segments of second order curves.

Claim 3 (original). Apparatus according to claim 1, wherein at least one of said troughs has a cross section defined by a set of coordinates.

Claim 4 (original). Apparatus according to claim 1, wherein at least one of said troughs has a cross section defined by a second order curve.

Claim 5 (original). Apparatus according to claim 4, wherein the second order curve is a parabola.

Claim 6 (original). Apparatus according to claim 4, wherein the second order curve is a portion of an ellipse.

Claim 7 (original). Apparatus as claimed in claim 1, wherein each reflector of said first set of reflectors is a continuous reflector.

Claim 8 (original). Apparatus according to claim 1, wherein each trough has a longitudinal axis, and wherein each reflector of said first set of reflectors is segmented and comprises:

- a first flat reflector segment extending from a first one of said troughs at an angle to the longitudinal axis of such trough; and
- a second flat reflector segment extending from a second one of said troughs at an angle to the longitudinal axis of that trough and cooperating with said first flat reflector segment to define a V substantially midway between said troughs.

Claim 9 (original). Apparatus according to claim 8, wherein the V forms an angle of substantially 90°.

Claim 10 (original). Apparatus according to claim 1, wherein each reflector of said first set of reflectors is curved.

Claim 11 (original). Apparatus according to claim 1, wherein each source of irradiation comprises a source of light for producing light to irradiate said fluid passageway.

Claim 12 (original). Apparatus according to claim 11, wherein each source of light comprises a source of ultraviolet light.

Claim 13 (original). Apparatus according to claim 12, wherein each source of ultraviolet light comprises a microwave electrodeless discharge bulb.

Claim 14 (original). Apparatus according to claim 12, wherein each source of ultraviolet light comprises an arc discharge bulb.

Claim 15 (original). Apparatus according to claim 12, wherein each source of ultraviolet light comprises a fluorescent discharge bulb.

Claim 16 (original). Apparatus according to claim 11, wherein said fluid passageway has a central axis, and each source of light comprises a tubular bulb having a longitudinal axis substantially parallel to the central axis of said fluid passageway.

Claim 17 (original). Apparatus according to claim 1, wherein said fluid passageway has a central axis, and each source of irradiation has a tubular shape with a longitudinal axis substantially parallel to the central axis of said fluid passageway.

Claim 18 (original). Apparatus according to claim 1, wherein both said at least one source of irradiation and said fluid passageway are spaced from all focal axes of said troughs.

Claim 19 (original). Apparatus according to claim 10, wherein each trough has a longitudinal axis, and said fluid passageway is on one of the longitudinal axes.

Claim 20 (original). Apparatus according to claim 1, wherein each trough has a longitudinal axis, and said fluid passageway is spaced from all the longitudinal axes.

Claim 21 (original). Apparatus according to claim 1, wherein said fluid passageway and said at least one source of irradiation are positioned so as to provide a substantially two-dimensionally uniform irradiation distribution across a cross-sectional plane of the fluid flowing in said fluid passageway.

Claim 22 (original). Apparatus according to claim 1, wherein said fluid passageway and said at least one source of irradiation are positioned so as to provide a substantially three-dimensionally uniform irradiation distribution within a volume of fluid flowing in said fluid passageway.

Claim 23 (original). Apparatus according to claim 1, wherein each trough has a focal axis within the trough, and each source of irradiation is positioned between the focal axis and the elliptical end of the respective one of said troughs.

Claim 24 (original). Apparatus according to claim 1, wherein each trough has a first focal axis and a second focal axis, and the second focal axes of all of said troughs are substantially coincident.

Claim 25 (original). Apparatus according to claim 1, wherein each trough has a longitudinal axis, and the longitudinal axes define a figure having a center of symmetry.

Claim 26 (original). Apparatus as claimed in claim 25, wherein said source of irradiation has a longitudinal axis, and said fluid passageway has a central axis extending substantially through the center of symmetry of the figure and substantially parallel to the longitudinal axis of said source of irradiation.

Claim 27 (original). Apparatus as claimed in claim 1, having a single source of irradiation and two troughs.

Claim 28 (original). Apparatus as claimed in claim 27, wherein each trough has a focal axis, and said fluid passageway is on the focal axis of one of said troughs, and said source of irradiation is spaced from the focal axes and is adjacent the focal axis of the other said troughs.

Claim 29 (original). Apparatus as claimed in claim 27, wherein each trough has a focal axis, and said source of irradiation is on the focal axis of one of said troughs, and said fluid passageway is spaced from the focal axes and is adjacent the focal axis of the other of said troughs.

Claim 30 (original). Apparatus according to claim 27, wherein said two troughs have coinciding longitudinal axes.

Claim 31 (original). Apparatus as claimed in claim 27, wherein said two troughs have non-coinciding longitudinal axes.

Claim 32 (original). Apparatus as claimed in claim 31, wherein said two troughs have parallel longitudinal axes.

Claim 33 (original). Apparatus as claimed in claim 32, wherein said source of irradiation has a longitudinal axis, and said fluid passageway has a central axis extending between the longitudinal axes of said troughs and substantially parallel to the longitudinal axis of said source of irradiation.

Claim 34 (original). Apparatus according to claim 31, wherein said source of irradiation is on the longitudinal axis of one of said troughs and said fluid passageway is on the longitudinal axis of the other of said troughs.

Claim 35 (original). Apparatus as claimed in claim 1, having two sources of irradiation and two troughs.

Claim 36 (original). Apparatus as claimed in claim 35, wherein each trough has a first focal axis and a second focal axis, the second focal axes of said troughs coincide, said fluid passageway is on the second focal axes, and each of said sources of irradiation is spaced from a respective one of the first focal axes.

Claim 37 (original). Apparatus as claimed in claim 35, wherein each trough has a first focal axis and a second focal axis, the second focal axes of said troughs coincide, each of said two sources of irradiation is on the first focal axis of a respective one of said troughs, and said fluid passageway is spaced from the second focal axes.

Claim 38 (original). Apparatus according to claim 35, wherein said two troughs have coinciding longitudinal axes.

Claim 39 (original). Apparatus as claimed in claim 35, wherein said two troughs have non-coinciding longitudinal axes.

Claim 40 (original). Apparatus as claimed in claim 39, wherein said two troughs have parallel longitudinal axes.

Claim 41 (original). Apparatus as claimed in claim 40, wherein said sources of irradiation have parallel longitudinal axes, and said fluid passageway has a central axis extending between the longitudinal axes of said troughs and substantially parallel to the longitudinal axes of said sources of irradiation.

Claim 42 (original). Apparatus according to claim 39, wherein said source of irradiation is on the longitudinal axis of one of said troughs and said fluid passageway is on the longitudinal axis of the other of said troughs.

Claim 43 (original). Apparatus according to claim 1, wherein each trough has a longitudinal axis, and the longitudinal axis of each trough intersects the longitudinal axis of each angularly adjacent trough at an angle equal to $2\pi/N$, where N is the number of troughs.

Claim 44 (original). Apparatus according to claim 43, wherein the longitudinal axes of the troughs intersect at a single intersection.

Claim 45 (original). Apparatus according to claim 44, wherein said fluid passageway has a central axis passing through the intersection of the longitudinal axes.

Claim 46 (original). Apparatus according to claim 43, wherein said fluid passageway has a central axis passing through the center of symmetry of a figure defined by the points of intersection of the longitudinal axes of said troughs.

Claim 47 (original). Apparatus according to claim 43, having four sources of irradiation, and wherein $N=4$.

Claim 48 (original). Apparatus as claimed in claim 47, wherein the longitudinal axes of said troughs intersect at a single intersection.

Claim 49 (original). Apparatus according to claim 48, wherein said fluid passageway has a central axis passing through the intersection of the longitudinal axes.

Claim 50 (original). Apparatus according to claim 47, wherein said fluid passageway has a central axis passing through the center of symmetry of a figure defined by the points of intersection of the longitudinal axes of said troughs.

Claim 51 (original). Apparatus according to claim 1, further comprising a mount for each source of irradiation, making the position of each source of irradiation adjustable so as to provide a substantially two-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

Claim 52 (original). Apparatus as claimed in claim 51, wherein each mount is adapted to be adjustably positioned on a mounting surface.

Claim 53 (original). Apparatus as claimed in claim 51, wherein each source of irradiation is adjustably mounted to said mount.

Claim 54 (original). Apparatus according to claim 1, further comprising a mount for each source of irradiation, making the position of each source of irradiation adjustable so as to provide a substantially three-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

Claim 55 (original). Apparatus as claimed in claim 54, wherein each mount is adapted to be adjustably positioned on a mounting surface.

Claim 56 (original). Apparatus as claimed in claim 54, wherein each source of irradiation is adjustably mounted to said mount.

Claim 57 (original). Apparatus according to claim 1, further comprising a mount for each trough, making the position of each trough adjustable so as to provide a substantially two-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

Claim 58 (original). Apparatus as claimed in claim 57, wherein each mount is adapted to be adjustably positioned on a mounting surface.

Claim 59 (original). Apparatus as claimed in claim 57, wherein each trough is adjustably mounted to one of said mounts.

Claim 60 (original). Apparatus according to claim 1, further comprising a mount for each trough, making the position of each trough adjustable so as to provide a substantially three-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

Claim 61 (original). Apparatus as claimed in claim 60, wherein each mount is adapted to be adjustably positioned on a mounting surface.

Claim 62 (original). Apparatus as claimed in claim 60, wherein each trough is adjustably mounted to one of said mounts.

Claim 63 (original). Apparatus according to claim 1, further comprising an adjustable mount for said fluid passageway, making the position of said fluid passageway adjustable so as to provide a substantially two-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

Claim 64 (original). Apparatus as claimed in claim 63, wherein said mount is adapted to be adjustably positioned on a mounting surface.

Claim 65 (original). Apparatus as claimed in claim 63, wherein said fluid passageway is adjustably mounted to said mount.

Claim 66 (original). Apparatus according to claim 1, further comprising an adjustable mount for said fluid passageway, making the position of said fluid passageway adjustable so as to provide a substantially three-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

Claim 67 (original). Apparatus as claimed in claim 66, wherein said mount is adapted to be adjustably positioned on a mounting surface.

Claim 68 (original). Apparatus as claimed in claim 66, wherein said fluid passageway is adjustably mounted to said mount.

Claim 69 (original). A method of providing a substantially two-dimensionally uniform irradiation distribution across a cross-sectional plane of a fluid flowing in a fluid passageway, said method comprising:

providing the apparatus according to claim 1;

positioning at least one of (a) said fluid passageway and (b) said at least one source of irradiation such that defocused irradiation from said at least one source of irradiation irradiates the fluid in said fluid passageway with a substantially two-dimensionally uniform irradiation distribution; and

activating said at least one source of irradiation.

Claim 70 (original). A method of providing a substantially three-dimensionally uniform irradiation distribution within a volume of a fluid flowing in a fluid passageway, said method comprising:

providing the apparatus according to claim 1;

positioning at least one of (a) said fluid passageway and (b) said at least one source of irradiation such that defocused irradiation from said at least one source of irradiation irradiates the fluid in said fluid passageway with a substantially three-dimensionally uniform irradiation distribution; and

activating said at least one source of irradiation.

Claim 71 (original). A method of providing a substantially two-dimensionally uniform irradiation distribution across a cross-sectional plane of a fluid flowing in a fluid passageway, said method comprising:

providing the apparatus according to claim 1;

shifting at least one trough such that defocused irradiation from said at least one source of irradiation irradiates the fluid in said fluid passageway with a substantially two-dimensionally uniform irradiation distribution; and

activating said at least one source of irradiation.

Claim 72 (original). A method as claimed in claim 71, wherein said at least one trough has a longitudinal axis and is shifted in a direction substantially perpendicular to the longitudinal axis of such trough.

Claim 73 (original). A method of providing a substantially uniform three-dimensional irradiation distribution within a volume of fluid flowing in a fluid passageway, said method comprising:

providing the apparatus according to claim 1;

shifting at least one trough such that defocused irradiation from said at least one source of irradiation irradiates the fluid in said fluid passageway with a substantially three-dimensionally uniform irradiation distribution; and

activating said at least one source of irradiation.

Claim 74 (original). A method as claimed in claim 73, wherein said at least one trough has a longitudinal axis and is shifted in a direction substantially perpendicular to the longitudinal axis of such trough.

Claim 75 (original). A method of treating a fluid flowing in a fluid passageway, comprising:
providing the apparatus according to claim 1;
passing a fluid through said fluid passageway;
irradiating the fluid in said fluid passageway with irradiation produced by said at least one source of irradiation; and
activating said at least one source of irradiation.

Claim 76 (original). A method according to claim 75, wherein irradiating the fluid comprises irradiating the fluid with ultraviolet light.

Claim 77 (original). A method according to claim 76, wherein said fluid includes a material to be disinfected, and wherein irradiating the fluid disinfects the material flowing in said fluid passageway.

Claim 78 (original). A method according to claim 76, wherein the fluid includes a material to be purified, and wherein irradiating the fluid purifies the material flowing in said fluid passageway.

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Claim 79 (original). A method according to claim 76, wherein the fluid includes a material to be oxidized, and wherein irradiating the fluid causes oxidation of the material flowing in said fluid passageway.

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IX. Evidence Appendix

None

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X. **Related Proceedings Appendix**

None